REMARKS

Claims 16-24 and 37-39 are pending in this application. Claims 37-39 have been added. The specification has been amended to correct minor typographical errors. No new matter is presented by way of these amendments.

Rejections under 35 U.S.C. § 103

Claim 16 was rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 6,337,163 to Sato. As will be explained below, Sato does not teach or disclose each feature of claim 16.

The present invention as defined by claim 16, provides a method for converting a top portion of a developed silicon containing photoresist layer (previously exposed to UV light from a lamp or laser for defining the resist pattern) disposed over a non-silicon containing photoresist layer. The developed silicon containing photoresist layer is exposed to ultraviolet (UV) light, thereby cross-linking polymer chains in the silicon containing photoresist. The cross-linking activated by the UV light results in converting a top portion of the developed silicon containing photoresist layer to a hardened layer. The non-silicon containing photoresist layer is unaffected by the UV light exposure as a result of not containing the cross-linking agent, i.e., silicon.

Applicants respectfully submit that nowhere does Sato teach or disclose the feature of a substrate with a developed silicon-containing photoresist layer disposed over

a non-silicon containing photoresist layer or the feature of converting a top portion of the developed silicon-containing photoresist layer to a hardened layer when the developed silicon-containing photoresist layer is disposed over a non-silicon containing photoresist layer. Sato defines a method for improving the alignment precision for patterns defined by UV exposure and charged beam exposure, i.e., provides for patterning a photoresist through the application of light exposure and electron beam exposure. The configuration of Sato requires that the underlying film 12, which may be an organosilicon compound, be below a resist layer 13. Sato describes two embodiments. A first embodiment is described through Example 1, the underlying film 12 is limited to an organosilicon compound (See column 99, line 32 through column 100, line 36). This is due to this first embodiment requiring a material whose etching rate would be lowered by the irradiation of a charged beam (See column 5, lines 53-62). Thus, the electron beam exposure results in the conversion of the organosilicon compound to a silicon oxide/carbide like film (See column 5, lines 64-67). Moreover, the first embodiment uses UV light to develop the photoresist mask (See column 97, lines 43-48). The exposed substrate is then baked and developed. Thus, the first embodiment of Sato does not teach or disclose applying UV light to the developed photoresist.

The Examiner compares Figures 1C and 1D of Sato to come to the conclusion that the electron beam organosilicon regions have a greater resistance to subsequent etching than the etching mask. Applicants respectfully submit that this conclusion has no support in the specification of the Sato reference and respectfully request that the Examiner particularly point out where the support for this conclusion is when in fact the specification states that both are equally excellent (See column 102 lines 11-22).

Moreover, the specification goes on to state that the organosilicon layer defined as underlying layer 12 is highly etchable as compared to both the resist layer 13 and the exposure region 16, thus enabling the excellent anistropic etching (See column 102, lines 16-30). Furthermore, the silicon oxide/carbide like film results from exposure of the underlying film to a charged beam, not ultraviolet light. Additionally, the charged beam is applied to define a pattern on the underlying film that is subsequently developed.

The second embodiment discussed by Sato uses a material other than an organosilicon compound as the underlying layer. According to the Examiner, Example 5 provides a potential use for a non-organosilicon underlayer in a similar process that involves similar patterning of an overlying resist before etching an underlying layer. Applicants respectfully traverse this characterization of the second embodiment. As depicted in Figures 5A-5E, the second embodiment defines a first resist pattern for a top resist layer, determines the position of the first resist pattern and then defines a second resist pattern for the top resist layer. The first resist pattern is defined through exposure to an electron beam and then developed, and the second resist pattern is defined through exposure to a KrF excimer laser. This second pattern is then developed by baking and application of a developing solution (See column 107, line 56 through column 108, line 2). The present invention, as claimed, defines a developed silicon-containing photoresist layer over a non-silicon containing photoresist layer. The developed photoresist layer is then exposed to UV light to convert a top portion of the developed silicon containing photoresist. Thus, the process defined by Sato in Example 5 is not similar to the claimed invention at all.

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the reference or in the knowledge generally available to one having ordinary skill in the art, to modify the reference. As discussed below, the Examiner has not established a *prima facie* case of obviousness because one having ordinary skill in the art would not have modified the reference in the manner proposed.

Specifically, there is no motivation to modify the reference as suggested by the Examiner. Sato deals with applying UV light to an undeveloped photoresist to define a mask pattern, while the claimed invention deals with the application of UV light to a developed photoresist to convert a portion of the developed photoresist to a hardened layer. Furthermore, the Examiner asserts that the hardened organosilicon photoresist (having a top portion converted to a silicon oxide/carbide film) is expected to provide greater etching resistance than the non-organosilicon resist. First of all, as mentioned above there is no basis for asserting the silicon oxide/carbide film has a greater etching resistance than the non-organosilicon resist. Secondly, the silicon oxide/carbide film is a result of the charged beam being applied to the undeveloped photoresist and not the UV light being applied to the developed photoresist. The Applicants respectfully disagree with the Examiners assertion that it would have been obvious to modify Sato so that the organosilicon polymer containing imaged and developed photoresist be placed on top of the non-organosilicon containing photoresist when Sato requires that the underlying film be a material whose etching rate would be lowered by the irradiation of a charged beam such as an organosilicon compound (See column 5, lines 52-54). The Applicants are unable to find any other examples for the underlying film in Sato besides the abundance of organosilicon compound listed by Sato. Accordingly, the Applicants respectfully

request that Sato be read as a whole when being considered by the Examiner. Thus, the applicants disagree that Sato may be modified as suggested by the Examiner since the Examiner is ignoring the requirements defined within Sato.

Furthermore, even if it is deemed that there would have been proper motivation to modify the reference, a proposition with which Applicants disagree, the result would not include all the claimed features of claim 16. As discussed above, Sato fails to teach or disclose the feature of a substrate with a developed silicon-containing photoresist layer disposed over a non-silicon containing photoresist layer or the feature of converting a top portion of the developed silicon-containing photoresist layer to a hardened layer when the developed silicon-containing photoresist layer is disposed over a non-silicon containing photoresist layer.

Claim 18 depends from claim 16 and as such includes all of the features of claim 16. As mentioned above, Sato fails to teach or suggest the feature of a substrate with a developed silicon-containing photoresist layer disposed over a non-silicon containing photoresist layer or the feature of converting a top portion of the developed silicon-containing photoresist layer to a hardened layer when the developed silicon-containing photoresist layer is disposed over a non-silicon containing photoresist layer. Tsai is silent to both of the aforementioned features, therefore, Tsai fails to cure the deficiencies of Sato. Additionally, according to the Examiner it would have been obvious to expose the photoresist to UV hardening as taught by Sato in an etching chamber that provides UV emission prior to etching with the expectation of simplifying processing. The Applicants note that Sato requires the baking and development of the exposed photoresist.

Accordingly, using the chamber of Tsai to expose the undeveloped photoresist of Sato does nothing for the simplification of processing as the exposed photoresist must be baked and developed. Thus, Tsai does not cure the deficiencies of Sato.

Claims 19-23 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 6,337,163 to Sato in view of U.S. Patent 5,899,748 to Tsai et al., further in view of U.S. Patent 5,123,998 to Kishimura, further in view of U.S. Patent 6,479,820 to Singh et al. further in view of U.S. Patent 4,980,563 to George et al. Applicants respectfully submit the Kishimura, Singh, and George references do nothing to cure the deficiencies of the Sato reference discussed above. Accordingly, claims 19-23 are patentable over the cited art for at least the reasons stated above.

Claim 24 was rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 6,337,163 to Sato in view of U.S. Patent 6,451,512 to Rangarajan et al. Rangarajan teaches post development photoresist silylation of a photoresist under UV light. Applicants respectfully submit the Rangarajan reference does nothing to cure the deficiencies of the Sato reference discussed above. Furthermore, the Examiner states that it would have been obvious to combine the references to harden 2% to 100% of the developed photoresist layer to improve selectivity. Applicants respectfully submit that there is no motivation to combine the references as proposed by the Examiner. Sato teaches an underlying organosilicon film. As the underlying film has a silicon component, there is no need to perform post development silylation. Furthermore, silylation of the underlying layer would cause the entire layer to become hardened, thereby, preventing the formation of the pattern under Sato. Thus, the combination as

proposed by the Examiner would render Sato unsatisfactory for its intended purposes in that a subsequent pattern would not be able to be developed.

Claims 37-39 have been added. Claim 37 includes the features discussed above and for at least the reasons stated above, the Applicants respectfully submit that claim 37 is not taught or disclosed by the cited art.

In view of the foregoing, Applicants respectfully submit that all of the pending claims are in condition for allowance. A notice of allowance is respectfully requested. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at **(408) 749-6900 x6921**. If any fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees to Deposit Account No. 50-0805 (Order No. LAM2P257). A copy of the transmittal is enclosed for this purpose.

Respectfully submitted,

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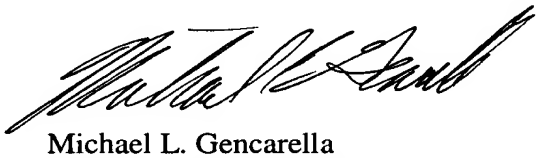

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